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GRAINS RESEARCH
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CORPORATION

BARLEY

SECTION A

INTRODUCTION

CROP OVERVIEW | MALT AND FEED BARLEY

Introduction

A.1 Crop overview

Barley (*Hordeum vulgare*) is a widely grown and highly adaptable winter cereal crop used mainly for the production of malt for the brewing industry and for stock feed.

Barley is an annual plant that has been selected from wild grasses. It is thought to have been an important food crop from as early as 8000 BCE (Before Common Era) in the Mediterranean and Middle East region (Photo 1).

Because of barley's tolerance of salinity, by 1800 BCE it had become the dominant crop in irrigated regions of southern Mesopotamia, and it was not until the early CE period that wheat became more widely grown.



Photo 1: Barley has long been an important food crop.

Source: Rachel Bowman (Seedbed Media)

Planting

Barley is very versatile in its planting time, being slightly more frost tolerant (1°C) than wheat prior to ear emergence and at flowering, and can be planted earlier in the season.¹

For more information, see Section 14.1: Frost.

It is also often a better option than wheat for late planting, especially if feed-grain prices are good. Preferred planting times are from late April to mid-May but this will vary for each region, depending on frosts and seasonal effects.

Early planting may produce higher yields, larger grain size and lower protein levels, making it more likely to achieve malt quality. However, early crops are more likely to have exposure to frost and growers should assess the frost risk for their area prior to sowing. Late plantings will often mature in hot dry weather, which can reduce grain size, yield and malting quality.

Nitrogen

Management of nitrogen (N) availability is vital to achieve optimal yields and quality in barley crops. The level of N and plant available water will impact strongly on yield and protein, which impacts on crop return. Unlike wheat where premiums are available

¹ DAF Qld (2012) Barley planting, nutrition and harvesting. Department of Agriculture and Fisheries Queensland, <http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-nutrition-harvesting>

for high protein, premiums for malting require moderate proteins of 9.5–12.5% for Malt1. ²

Production

Australia produces high-quality two-row spring-type barley, with annual production averaging ~7.5 Mt/year. It is a widely grown crop (second only to wheat) and occupies a large geographic area—almost 4 M/ha, dispersed from Western Australia (WA) to southern Queensland.

According to Grain Industry of Western Australia (GIWA), WA produced more than four million tonnes of barley in 2016 and yielded an estimated 2.96 tonnes per hectare.

Australia has an enviable reputation for producing a reliable supply of high-quality, contaminant-free barley that is sought after by the malting, brewing, distilling, shōchū (Japanese distilled spirit) and feed industries.

Australia produces around 2.5 Mt of malting barley and 4.5 Mt of feed barley; the average Australian malting selection rate is the highest of the world’s exporting nations, with ~30–40% of the national crop selected as malting.

Domestically, malting barley demand is ~1 Mt/year and Australian domestic feed use ~2 Mt/year. Domestic brewers are tightly linked to Australia’s barley production, and strong relationships exist between all facets of the industry, from breeder to brewer and all stages in between.

A.1.1 Western Australian barley industry

Barley is WA’s second most important crop after wheat delivering the State around \$1 billion in export grain and malt earnings in recent years. Production area remains relatively constant while production has more than doubled from 2000 to 2016 (Figure 1). Western Australia is a leading supplier of malting barley to China and shōchū barley to Japan and a major supplier of feed barley to the Middle East and China (Photo 2). The Department of Agriculture and Food WA (DAFWA) is involved in all aspects of the barley value chain from variety development and assessment through to grain quality research and market intelligence to determine export market needs.

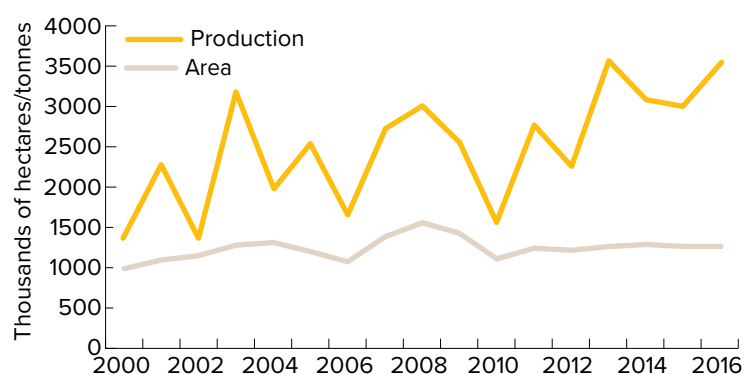


Figure 1: WA Barley Area and Production 2000 to 2016.

Source : DAFWA

There are two malting plants in WA, Joe White in Forrestfield and Kirin in Welshpool. The Joe White facility is the largest barley malting facility in the Southern Hemisphere. Between the two plants, about 250,000 tonnes of barley are malted each year, with the majority of the malt being exported.

A national pilot malting facility established in WA in 2010 has enabled smaller quantities of malting barley to be tested using commercial malting processes. The pilot plant will speed the identification of promising new malting barley varieties and also enable the beer-quality attributes of WA malting varieties to be demonstrated to export customers.

Exports

The majority of barley produced in WA is exported, delivering the state about \$800–900 million in export revenue. Malt exports are worth an additional \$120 million each year for the state.

As the nation's largest producer of malting barley, WA provides the majority of these exports to China with 40% of barley produced delivered as malting grade. The remaining 60% is delivered as feed grade, the majority of which is sent to the Middle East, although China is emerging as a major market for feed barley as well.³

Brand identity for WA

With beer consumption on the rise in South-East Asia, the South East Premium Wheat Growers' Association (SEPWA) is looking to generate a brand identity for WA malting barley.

In 2016 the Esperance-based grower group received \$413,410 through the DAFWA Grower Group Research and Development Program to fund a three-year project.

The 'barley brand development for Asian consumers' project will develop a working relationship between the Asian-based malting company Internalt and growers in the Esperance Port Zone.

The relationship with Internalt, an arm of Interflour which is partly owned by Co-operative Bulk Handling Ltd, will integrate market end-user intelligence and on-farm agronomy to try to establish WA barley as a preferred supply source for Asian brewers.

SEPWA's field-trials program will conduct further technical assessment of WA barley. Testing varieties for malting suitability will help to introduce new varieties to the marketplace, as well as optimise already proven barley varieties.

SEPWA will supply barley samples from variety trials for three seasons for pilot and micro malting testing with Internalt and the Australian Export Grains Innovation Centre.

It is expected the result will be the faster adoption of new barley genetics for WA growers, as well as the establishment of WA barley as a premium supply source. This will help growers understand the agronomic effects on end-user performance and market demand, and also help develop supply-chain relationships. Grower and end-user relationship is critical to the overall brand development of WA barley, as well as further developing grain export opportunities in Asia.⁴

3 | Wilkinson (2016) Western Australian barley industry. Department of Agriculture and Food, Western Australia, <https://agric.wa.gov.au/n/1464>

4 | GRDC (2016) WA malt barley push into Asia. GRDC Ground Cover Issue 124, September-October 2016, <https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-124-SeptemberOctober-2016/WA-malt-barley-push-into-Asia>



Photo 2: WA is a leading supplier of malting barley to China.

Over the past five years, Australian barley farmers produced an average of 7.5 Mt of grain per year, of which around two-thirds was exported.

Australia is the world's second-largest exporter of barley and supplies almost 30% of the world's barley trade. Saudi Arabia, Japan and China are large importers of Australian barley, and these markets are growing rapidly.⁵

In addition, Australia exports around 1.5 Mt of malting barley and ~2.5 Mt of feed barley representing ~20% of the global feed-barley trade. Major exporting states are WA and South Australia, where domestic demand for malting and feed barley is considerably smaller than in the eastern states.⁶

Varieties

Selecting a variety with proven performance in the region is important. If trying a new variety, it is important to compare it with a variety previously grown. Factors to take into consideration for variety selection include:

- suitability of the variety for the region
- time of planting
- available moisture at planting
- disease risks
- yield potential
- standability and straw strength
- soil N status (i.e., starting N levels not high for malting barley)
- marketing options—malt versus feed
- rotation (past crops and future planting intentions)
- availability of seed⁷

Barley growers have access to a number of barley varieties. Identifying the variety that is best suited to a region and that will give the greatest return requires consideration of factors including relative yield, disease resistance, the probability of achieving particular quality grades and their associated prices.

The decision to grow either a malting or feed variety may depend on one or more factors, including: the difference in income between malting and feed grades relative to yield differences i.e. the gross margin; the probability of producing a malting grade barley; availability of malting storage segregations in storage facilities; and disease resistance and agronomic considerations.

Contact grain marketers to discuss market demand prior to sowing a malting variety. Malting barley is grown, stored and sold on a variety-specific basis and it is

⁵ N Fettel, P Bowden, T McNee, N Border (2010) Barley growth & development. PROCROP Series. Industry & Investment NSW/ NSW Department of Primary Industries. http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

⁶ Barley Australia (2014) Industry information. Barley Australia, <http://www.barleyaustralia.com.au/>

⁷ DAF Qld (2013) Barley planting and disease guide. Department of Agriculture and Fisheries Queensland, <http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-disease-guide>

 **MORE INFORMATION**

[GRDC \(2014\): Barley holy grail. Driving agronomy podcast](#)

[GIWA \(2016\) Grain standards in Western Australia.](#)

important to ascertain whether the variety chosen can be stored and marketed in a particular area.⁸

Malting quality

Paddock selection and N management are often the keys to producing malting quality.⁹ Growers should record paddock rotations and use soil and tissue testing to ensure adequate nutrition.

Use adequate N fertiliser but do not overfertilise because this will encourage excessive vegetative growth and could result in lodging. If applied late, it could also result in excess protein levels (above malting requirements). Phosphorus, zinc and sulfur levels are also important. A starter fertiliser is recommended.¹⁰

End-uses

Australian barley is highly regarded around the world. Uses for Australian malted barley include:

- beer
- shochu, whiskey and other distilled spirits
- malt extract
- malt vinegar
- confectionary
- flavoured sweet drinks
- breakfast cereals¹¹

A.2 Malt and feed barley

Malt is produced from a cereal grain (usually barley) that has been allowed to germinate for a limited period of time prior to undergoing a mild kilning.

During the malting process, raw barley is steeped, germinated and kilned to change the raw barley seed into a friable, biscuit-like texture, which from the outside looks just like a barley kernel.

It is then easily crushed in the brewery mill in preparation for the sugar conversion that takes place in the brewery mash tun. The malting process converts ~10% of the carbohydrate in the raw grain into fermentable sugars via the process of germination. The malting process prepares the grain for more modification, which will be undertaken in the brewhouse.

For the Australian barley industry, there are two distinct markets to service—a domestic market and an export market—each of which has different requirements and needs for malt and raw barley. This is due to fundamentally different styles and methods of brewing. In Australia brewers use sugar as an adjunct, whereas in Asia solid adjuncts such as rice are predominantly used in the brewing process.

The malting process causes numerous chemical reactions to occur between amino acids and reducing sugars to develop colour and flavour compounds. Malt extract is a natural flavouring and colouring that is high in protein and natural sugars, and is a major natural energy source. In addition to its use in brewing, it is widely used in baking, confectionery, breakfast cereals, malt beverages, dairy products and condiments, and as a caramel substitute.

8 Agriculture Victoria (2016) Growing barley. <http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-barley>

9 P Matthews, D McCaffery, L Jenkins (2015) Winter crop variety sowing guide 2014. NSW Department of Primary Industries. <http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide>

10 DAF Qld (2013) Barley planting and disease guide. Department of Agriculture and Fisheries Queensland. <http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-disease-guide>

11 AEGIC (2016) Barley. Australian Export Grains Innovation Centre. <http://aegic.org.au/about/australian-grains/barley/>

Australia produces >900,000 t of malt per year, with ~200,000 t consumed domestically (predominantly in the brewing industry) and >700,000 t exported predominantly into the Asian regional marketplace.¹²

Maltsters and brewers require brightly coloured barley for the production of high quality malt and brewed products. Poorly coloured or stained barley will only be bought as a last resort as it presents specific problems to end users. For example, weather stained barley will sometimes carry its poor colour through to the end product. Barley with fungal staining can cause more severe problems such as a low level of malt extract in the malt house, poor flavour, gushing or overfoaming and reduced shelf life of any beer produced from it.

Low moisture content is also important in malting barley, particularly when it is being stored for any length of time. Moisture levels above 12.5% in stored barley will promote fungal growth and cause the problems outlined above.

Protein is also an important factor when marketing malting barley. The ideal protein range is between 9.5–12.5%. Barley with protein levels either side of this range will cause quality problems in the end product and produce less malt extract per tonne.

Other quality aspects considered by malt barley buyers include grain plumpness and weight. The heavier the grain, the more malt per tonne will be extracted. Malting barley must also be of the one variety as each variety of barley behaves differently in the malthouse. Screenings and skinned grains must also be kept to a minimum as these will cause uneven germination during steeping and inconsistent malt.¹³

A.2.1 Feed barley

Barley is used as stock feed, especially in the intensive pig, poultry, dairy and beef industries. This demand is met by varieties specifically grown as high-yielding feed types as well as grain that does not meet the quality requirements for malting or human food.

A few varieties are suitable as a dual-purpose crop (i.e. for grazing by livestock and for grain). Other varieties lose too much yield potential if grazed. When barley crops are grazed, care must be taken with the use of pesticides. Observe the withholding periods for grazing or cutting for hay or silage.¹⁴

The two most important factors considered by feed barley buyers are grain colour and moisture content.

Grain brightness is important as many purchasers of feed barley on-sell to other end users. Primary buyers of feed barley will therefore attempt to purchase the brightest grain possible to increase their chances of on-selling at a premium price. In WA this means feed producers will prefer BFED1 over BFED2

Moisture levels are important for storage reasons. Feed barley is often stored for long periods and excessively moist barley will decline in quality due to the growth of microflora during storage.

Protein is a minor consideration for buyers of feed barley as it is bought primarily for its energy content rather than as a protein source.¹⁵

MORE INFORMATION

[2017 Barley variety sowing guide for Western Australia](#)

¹² Barley Australia (2014) Industry information: Malt. Barley Australia, <http://www.barleyaustralia.com.au/barley-and-malt>

¹³ DAFWA (1995) The Barley Book. Department of Agriculture and Food, Western Australia, <http://researchlibrary.agric.wa.gov.au/bulletins/44>

¹⁴ N Fettel, P Bowden, T McNee, N Border (2010) Barley growth & development. PROCROP Series. Industry & Investment NSW/NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

¹⁵ DAFWA (1995) The Barley Book. Department of Agriculture and Food, Western Australia, <http://researchlibrary.agric.wa.gov.au/bulletins/44/>